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(56) Documents Cited
GB1489084 A **EP 0493231 A1** **EP 0490825 A1**
EP 0388090 A1 **US4513056 A**

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(54) Improvement in security features for paper

(57) In a method of making paper selected areas are transparentised to provide enhanced security features. The method comprises the steps of depositing fibres onto a support surface to form a porous absorbent sheet, applying a composition comprising a transparentising resin containing an iridescent substance to at least a portion of said porous sheet and subsequently impregnating the porous sheet with a sizing resin. The resin may be applied by a screen printer (23) upstream of the size bath (18). The method may use a cylinder mould process as shown or a Fourdrinier process. The resin may be "fixed" by radiation. A luminescent dye may be added to the resin. Intaglio printing may also be used to apply the resin.

FIG. 1.

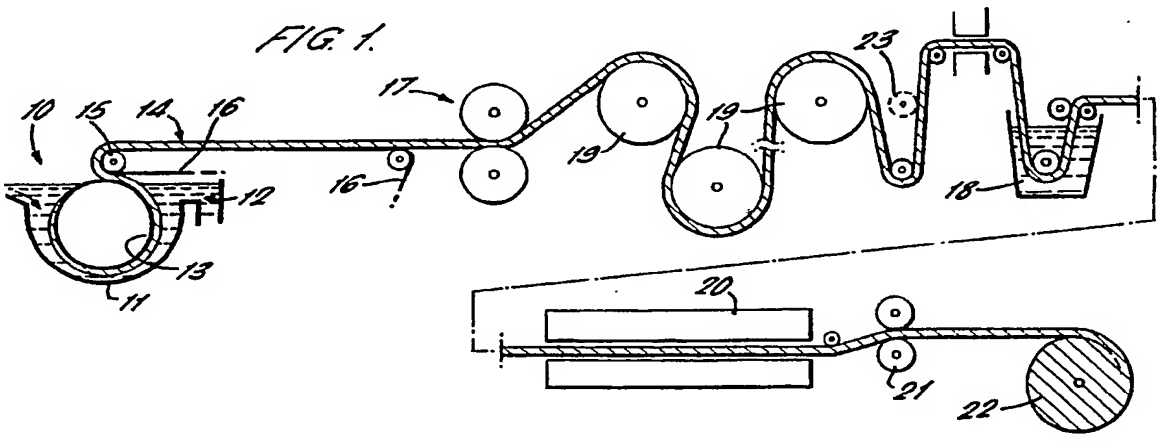

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FIG. 1.

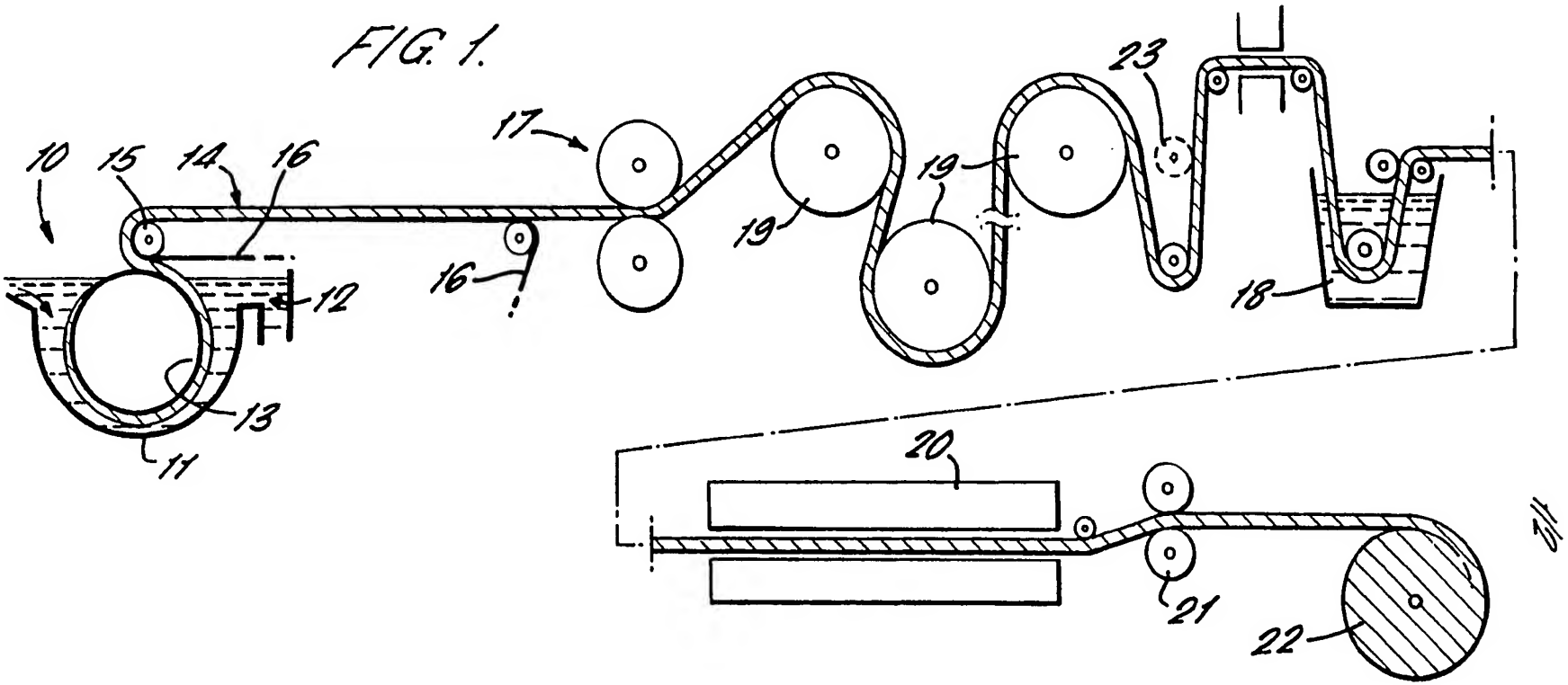


FIG. 2.

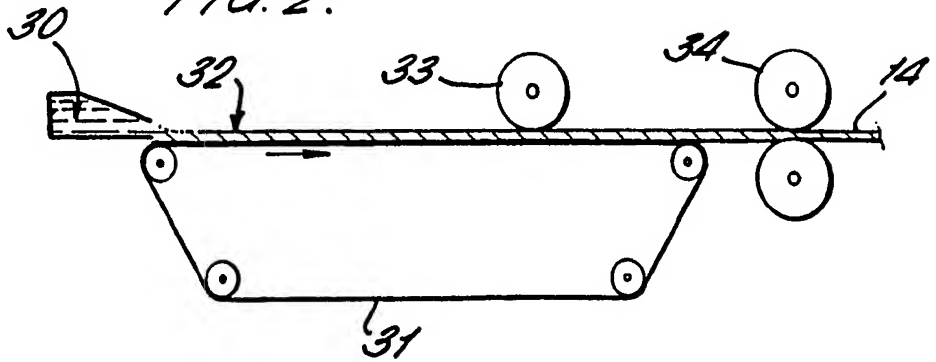


FIG. 6.

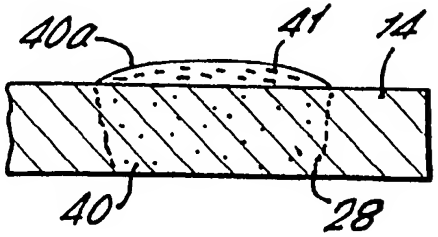


FIG. 3.

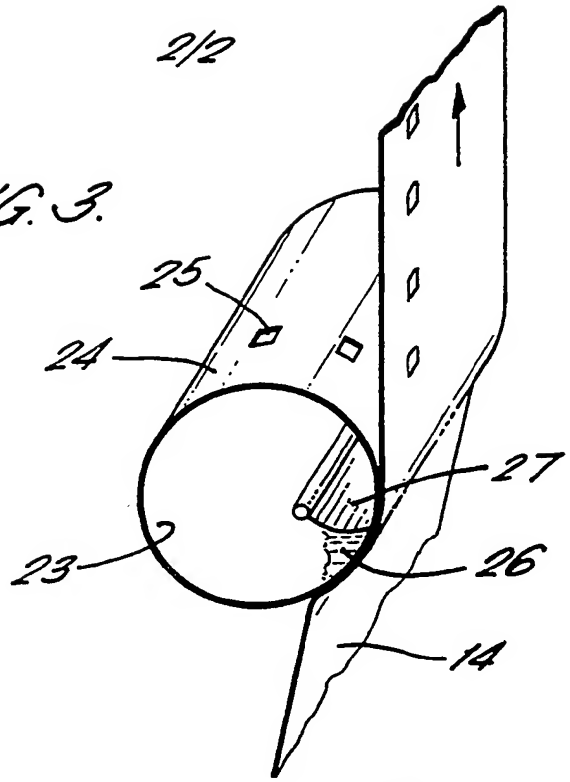


FIG. 4.

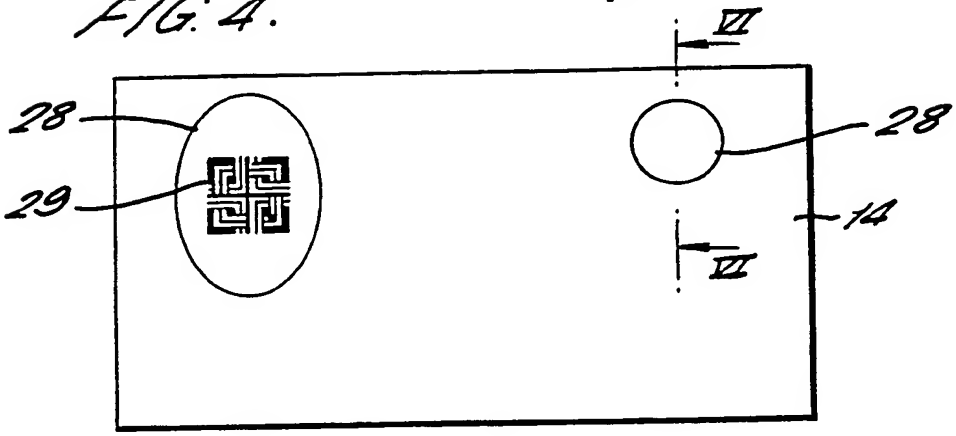
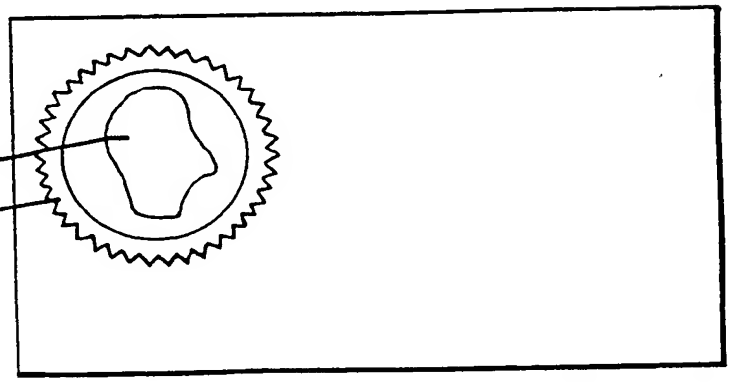


FIG. 5.



IMPROVEMENT IN SECURITY FEATURES FOR PAPER

The invention relates to improvements in security features in paper and in particular to a method of making paper and transparentising selected areas of paper to provide enhanced security features.

Documents of value and means of identification, such as banknotes, passports, identification cards and the like, are vulnerable to copying or counterfeiting. The increasing popularity of colour photocopiers and other imaging systems, and the improving technical quality of colour photocopiers, has led to an increase in the counterfeiting of such documentation. There is, therefore, a need to improve the security features of such documentation, or paper, to add additional security features or to enhance the perceptions and resistance to simulation of existing features. Steps have already been taken to introduce optically variable features into such documentation which cannot be reproduced by a photo-copier. There is thus a demand to introduce features which are discernible by the naked eye but "invisible" to, or viewed differently by, a photocopier. Since a photo- copying process typically involves reflecting high energy light off an original document containing the image to be copied, one solution is to incorporate one or more features into the document which have a different perception in reflected and transmitted light. Known examples of such security features include watermarks, embedded security threads, luminescent pigment and the like.

EP-A2-0203499 discloses a method of applying a pseudo watermark to paper. This method comprises the

preparation of a paper containing thermally sensitive material, the presence of which renders the translucency of the paper variable by temperature change. When heat is subsequently applied to a part of the surface of the paper, a region of the paper becomes semi-translucent.

US-A-2021141 discloses a method of applying pseudo watermarks to paper, by applying a resinous composition to finished paper which permeates the paper and causes it to become more transparent, or translucent, than the surrounding area.

GB-A-1489084 describes a method of producing a simulated watermark in a sheet of paper. The sheet is impregnated in the desired watermark pattern with a transparentising composition which, when submitted to ultra violet radiation, polymerizes to form a simulated watermark.

US-A-5118526 describes a method of producing simulated watermarks by applying heat, in the desired watermark pattern, onto a thin solid matrix of waxy material placed in contact with a sheet of paper. This results in an impression of a durable translucent watermark.

US-A-4513056 relates to a process for rendering paper either wholly or partially transparent by impregnation in a special bath of a transparentisation resin and subsequent heat cross-linking of the resin.

EP-A1-0388090 describes a method of combining a see-through or print-through feature with a region of paper which has a substantially uniform transparency

which is more transparent than the majority of the remainder of the sheet.

JP 61-41397 discloses a method for making paper transparent and a method for its manufacture for see-through window envelopes. The method utilises the effect of causing ink cross-linked by ultra-violet rays to permeate paper thus causing that part of the paper to become transparent.

All of these methods providing enhanced security features are for use with finished paper and for non-currency and non-security papers. They can be applied to wood pulp based papers for high volume commercial applications. Such substances are still quite porous with little inherent oil or grease resistance and the transparentising can be successful. Furthermore, in such applications it is highly desirable to have the transparentisation step as a separate process. Since there is a certain amount of spoilage in paper making, incorporating an additional process in the paper making has generally been avoided to avoid an increase in the spoilage. None of the prior art methods are furthermore particularly suitable for low absorbency low porosity papers, such as are used for banknotes. Such papers have generally been treated so as to minimise the uptake of oily substances and organic solvents. This is generally achieved by using a fibrous substrate designed to reduce the porosity of the paper and by impregnating the paper with any one of a variety of sizing resins such as polyvinylalcohol or gelatin and also by calendering the paper. The sizing and calendering processes help to reduce the porosity of the paper. Finished paper treated in this way does not lend itself to transparentisation because its low

absorbency inhibits the penetration of the transparentising resin, and, in the case of UV cured resins or those requiring a hot drying process, the moisture content of the paper is disturbed and this is likely to cause print runability problems at the printing stage.

It is an object of the invention described in our copending application filed simultaneously to provide a method of manufacturing paper of which at least a portion is transparentised to provide an enhanced security feature in counterfeiting or copying.

Alternative solutions to improving security features in paper have been proposed using the optical properties of surface iridescence.

EP-A-0 493 231 describes a printable sheet for manufacture of security documents having at least one iridescent coating situated at least partially on the surface of the sheet. The coating composition is made up from at least one binder, such as polyvinylchloride, and an iridescent substance which coating is applied to the finished paper.

FR-A-2641011 also discloses a printable sheet and includes on its surface a layer made up of at least one iridescent substance. The layer is deposited on the finished paper by a gravure printing process using an ink made up of a varnish and of an iridescent substance.

EP-A-0 490 825 also describes security paper which has a superficial colour coat made up of at least two adjoining surface areas in the form of

strips. The coat strips contain different iridescent pigments and exhibit a different colour when viewed from at least one oblique viewing angle range.

As with the prior art methods of transparentising paper, the prior art methods of applying iridescent coatings are only suitable for use with finished papers which have been treated to make them non-absorbent, low porosity papers.

It is an object of the present invention to provide a method of manufacturing paper of which at least a portion is transparentised and iridescent to provide an enhanced security against counterfeiting or copying.

It is to be understood that the term "security documents" emcompasses bank notes, cheques, passports, identification cards, share certificates, vouchers, coupons, tickets and the like.

It is also to be understood that the use of the term "iridescent substance" is understood to refer to a substance which, due to the interference of light reflected from the front and back of a thin film, shows changes of colour on the surface.

A preferred embodiment of the present invention will now be described in detail, by way of example only, with references to the accompanying drawings in which:-

Figure 1 is a schematic section through apparatus used in a method of manufacturing paper according to the invention; and

Figure 2 is a schematic section through alternative paper making apparatus for use in the method of manufacturing paper according to the invention;

Figure 3 is a perspective view of the rotary screen printer of Figure 1;

Figure 4 is a schematic representation of a security document made from paper according to the invention;

Figure 5 is a schematic representation of an alternative security document made from paper according to the invention; and

Figure 6 is a cross-sectional side elevation of an enlarged portion of the document of Figure 4 on the line VI-VI.

Referring to Figure 1, there is shown a cylinder mould paper making machine 10 comprises a vat 11 containing paper stock, i.e. a suspension of paper making fibres 12. The major portion of a horizontal cylinder mould 13 dips into the vat 11. The surface of the cylinder 13 is provided by a wire mesh which may be embossed and generally there are several layers of mesh employed, the outermost being the finest. Liquid is drawn through the mesh as the cylinder 13 is rotated causing paper making fibres to deposit on the mesh and form wet paper 14. The wet paper 14 is couched from the cylinder by couch roll 15 and conveyed away on a moving wire mesh 16.

The wet paper 14 then passes through a wet press 17 which squeezes the paper 14 to remove excess

water therefrom. The paper 14 is then dried over heated cylinders 19.

Although the present invention is described with reference to a cylinder mould paper making machine, which is the preferred method, the paper forming process can be achieved in many other ways. The most common alternative is the Fourdrinier system shown in Figure 2. In this paper making fibre stock is deposited from a stock applicator or flow box 30 on to a continuous moving wire mesh 31. Water from the fibre stock drains through the wire mesh 31 leaving a wet de-watered fibre mat 32. The fibre mat 32 passes under a dandy roll 33 which can be used to apply an embossed watermark. The wet paper then passes through a wet press 34 before being dried.

In a traditional paper making process the paper is impregnated with any one of a variety of sizing resins such as polyvinylalcohol (PVOH) or gelatin, to minimise the uptake of oily substances or organic solvents. The paper sheet 14 is passed through a size bath 18 so that it becomes saturated with size. The resulting paper is thus resistant to grease and has a lower absorbency and it is therefore more appropriate for use as banknote paper and the like. The paper sheet 14 is then passed through an air float, spar or other suitable dryer 20 for further drying before passing to a calendering device 21 to give a smooth surface before reeling 22.

In the modified process according to the invention, a screen printing process or other resin applicator is used to apply a transparentising resin containing an iridescent substance to the surface of the partially formed paper sheet 14 before it enters

the size bath 18. This is shown in more detail in Figure 3. The screen printer 23 is a rotary printer comprising a cylindrical screen 23 of flexible wire mesh mounted on a rigid steel rim covered by a stencil 24. The image required to be reproduced on the paper is formed in the stencil by means of an opening 25. As the paper sheet 14 passes the cylinder, the transparentising resin 26 is applied to the inside of the wire mesh and forced through the mesh with a squeegee blade 27 onto the paper sheet 14.

Some papers may be more appropriately treated by a gravure, flexo or other printing process, instead of the screen printing process.

The transparentising resin applied by the printing process is applied in the quantity of at least 5% by weight of resin to the partially formed paper sheet. In a preferred embodiment of the invention, the resin is applied in the quantity of at least 10% by weight of resin.

At this point the partially formed paper is at its most absorbent, thus allowing good penetration of the transparentising resin. In one embodiment of the invention, no curing process is used, and the sheet 14 is passed directly into the size bath 18. This prevents smudging of the mobile transparentising resin which is effectively frozen in position. This is an unexpected effect. As soon as the sheet 14 enters the size bath 18, the size fills the cells in the paper surrounding those containing the transparentising resin, thus preventing migration of the latter. The transparentising resin can thus be applied to a sharply defined region of the paper so as to create a transparent patch or pattern that is

capable of contributing to the overall resistance to counterfeiting of a security document made from the paper. The security document may be a banknote, a cheque, a passport, an identification card, a share certificate or the like.

An example of a security document made by this process is illustrated in Figure 4 which shows a sharply defined translucentized area 28. It should be noted that a transparentised area without the iridescent substance does not reflect as much light as the non-transparentised paper. Therefore the outline of the transparentised patch can be seen reasonably well in reflected light.

With the iridescent substance added to the transparentising resin, there is an unexpected synergistic effect both in reflective and transmitted light. A different colour shift can be seen as the paper is moved and examined in reflected light. A colour shift can also be seen when the light changes from transmitted to reflected light, although no colour change can be seen when the viewing angle is altered under just reflected light.

This effect can be explained with reference to Figure 6. When resin 40 containing particles 41 of an iridescent substance is applied to the paper 14, the resin 40 penetrates the pores of the paper 14. However, the particles 41 of the iridescent substance are of a size greater than the size of the pores of the paper 14 and so do not penetrate the paper. These particles 41 are left in a layer on the surface of the paper 14 in combination with some resin 40a which forms a layer on the surface of the paper 14. The resin therefore has a twofold purpose in that

where it penetrates the paper it causes a transparentising effect and where it remains on the surface of the paper it bonds the iridescent particles to form an iridescent coating. This provides a further enhancement of the anticounterfeitability of a security document as it shows clear and different effects in reflected as well as transmitted light.

In an alternative embodiment of the invention, the resin can be "fixed" by using EB or UV radiation cured resins whereby curing takes place shortly after application and prior to entry of the sheet 14 into the size bath 18. These resins have the advantage that, once cured, they are fixed and controlled.

The processing space between the printer 23 and size bath 18 can be limited; in an alternative embodiment of the invention the resin is cured after the partially formed sheet 14 has passed through the dryer 20 and before the calendar 21. To prevent the transparentising resin from transferring to the size bath rolls, a short pre-cure can take place prior to entry of the paper into the size bath 18. This enables the surface of the resin to be cured to prevent the transfer from taking place, whilst the rest of the resin within the body of the paper is not "fixed" until after the sizing process has taken place.

Alternatively the radiation cross-linking could take place between the dryer and the calender thereby providing the transparentising resin for a longer period of time to penetrate the paper 14.

When paper is produced using the process

described, two additional techniques can be applied to the process in order to increase the receptivity of the paper sheet 14 to the transparentising resin.

The resin can be applied to a low grammage part of the paper created by the well known processes of mould or dandy roll water marking. This results in a very significant enhancement of the watermark as the contrast between the lighter areas in the watermark are shown as colour changes. In the case of mould made watermarks, this also has the advantage of the creating a local area low in opacifying pigment such as titanium dioxide which further increases the transparentising effect of the transparentising resin and therefore the colour effect of the iridescent substance.

Instead of applying a resin to a plain low grammage part of the paper, the transparentising resin can also be applied to a decorative watermark 29, as shown in Figure 4. This significantly extends the usefullness of the transparentising and iridescent features as a deterrent to counterfeiters by markedly increasing its visual complexity and by generating within it an easily recognisable yet difficult to copy image.

When the translucency is controlled to give an opacity not less than 50%, an unexpected advantage is that the outline definition of the watermark is noticably enhanced.

In yet another alternative embodiment of the invention, illustrated in Figure 5, the resin can be applied as an outline or frame 36 around a watermark 37 or a low grammage patch of the paper which has the

effect of drawing attention to the watermark.

Alternatively, or in addition to the use in relation to a watermark, the transparentising resin can be applied to a streak in the paper. In the manufacturing of paper using a cylinder mould machine 10, it is possible to use a fibre locator to direct different types of fibres to certain places on the mould thus causing a streaking effect in the resulting paper. These different types of fibres may create a streak of more porous paper structure. Where such a streak is created it has the effect of enabling the transparentising resin to absorb into the area of streak better than the surrounding paper and as such can therefore be used to enhance the transparentising effect.

Alternatively, or in addition, a luminescent dye may be added to the transparentising resin and iridescent substance. This has a very important commercial effect as an ultra-violet lamp can give a transmitted luminescence which is normally only available in reflected light.

Additionally the luminescent transparentising resin may be applied to a decorative watermark. The result of the feature which, when viewed in UV transmitted light, reveals the shadow of the watermark. This is an unexpected effect and because of its striking appearance it is a useful security feature.

In yet another embodiment of the invention, the effect of the transparentising resin can be enhanced by the known process of intaglio printing which has the effect of embossing the paper. The combination

of heat and pressure used in the intaglio embossing process improves the distribution of resin through the paper, except in the case of non-thermo plastic resins such as the radiation cured type.

Traditionally titanium dioxide, or another opacifying pigment, is added to high quality security papers to reduce see-through and strike-through of print and to minimise undesirable paper luminescence. In order to maximise the transparentising effect of the resin, the level of titanium dioxide in the present invention is preferably kept to a minimum.

In yet another embodiment of the invention, the iridescent feature is applied in register with the watermark in both the machine and cross-direction. Unregistered features have the inherrent advantage of technical simplicity, but by the same token are markedly easier to counterfeit in quantity then registered features. Such a process requires the use of optical detectors that identify the watermark position and feeds this information back to the electronic unit that controls the drive of the printing screen in the case of screen printing. Alternatively, in the case of other printing methods, web tension control may be the mechanism by which register is achieved.

Examples of materials and compositions suitable for use in making paper according to the invention will be discussed as follows.

PAPER-MAKING FIBRES

Papers suitable for banknotes and security

documentation are made from a variety of fibres such as linen, abaca, wood pulp, cotton and blends thereof. Wood pulp is commonly used in non-banknote security documents, whilst cotton is the preferred fibre for banknotes. These cotton fibres are often from waste materials, such as off-cuts from the textile industry. The processed fibres have a ribbon-like profile which have a high surface-to-surface contact area. However, to produce appropriate cotton fibres for manufacturing banknote paper and the like, the fibres must be refined from their original tubular configuration by the mechanical process of defribrillation. In order achieve a high quality base paper, it is necessary to ensure that the preparation of the fibres is carefully carried out and that they are manipulated and defibrillated to the most appropriate length and drainage characteristics to achieve a good quality watermark, whilst also maintaining the high strength needed for paper. Such paper is generally made from fibre that has a Schopper Riegler value of 45^{o} - 70^{o}. Despite careful processing, the fibres are natural fibres and can vary from batch to batch, resulting in a variation of the porosity of the paper. Further porosity variations result from different specification demanded by different customers.

SIZING RESINS

It should be noted that the sizing resins referred to are surface sizing resins, as opposed to internal sizing resins. Preferably, traditional sizing resins such as polyvinylalcohol (PVOH) or gelatine are used as functionally these are generally the most successful. There are, however, many other

chemicals which can be used such as starch or emulsion based polymers.

Because of the variation in the quality of the paper fibres, the concentration of the size may also be varied during processing.

TRANSPARENTISING RESINS

As mentioned above, these may be known ultra violet (UV) curable, non-curable and cross-linkable resins.

The process of screen printing the transparentising resin onto the paper sheet 14 and the time taken for the resin to be absorbed into the paper depends, amongst other things, on the viscosity of the resin. As paper making machines run at different speeds and the properties of the base paper fibres can vary, it is necessary to control the viscosity of the resin in order to control the transparency of the paper. It is therefore recommended that two resins are taken from different ends of the viscosity spectrum, which can be blended to form a resin at an appropriate viscosity for the machine speed, the level of transparency to be achieved, the rate of absorbtion, and so on. Another option is also to add different levels of a wetting agent such as FC-430 Fluorad (trade mark) supplied by 3M which is a fluoroaliphatic polymericester. Thus if the base paper is of a lower porosity than ideal, such a wetting agent can be mixed with the resin and added at the screen printing stage.

The degree of penetration of resin can also be controlled depending on the quantity of resin

applied, the dwell time, the absorption rate and so on.

UV-Curable Resins - The preferred resins are 100% resins with no solvent incorporated. They have a Refraction Index in the region of 1.5 and a viscosity in the region of 400-1500 centipoise at 23°C. They should preferably be non-yellowing and transparent. As curable resins harden, it is also necessary that they should have appropriate physical strength requirements. For example, they must not be brittle.

Examples of such resins are Photomer 4061 (trade mark) which is a tripropylene glycol diacrylate and Photomer 5018 (trade mark) may be used, which is a polyester tetrofunctional acrylate, both supplied by Harcros Chemical (UK) Limited. These resins are generally at the opposite ends of the viscosity spectrum and can be combined to provide a suitable transparentising resin at an appropriate viscosity.

Non-curable resins - The physical criteria for a suitable non-curable resin are basically the same as those of the UV curable resins. Suitable materials include polybutene material such as Hyvis 7 (trade mark) which is a polyisobutylene supplied by BP Chemicals or Hyvis 5 (trade mark) which is also a polyisobutylene supplied by BP Chemicals. Hyvis 5 has a higher viscosity than Hyvis 7.

It should be noted that the non-curable resins generally stay in the liquid state and have no physical strength requirements. However, for the purposes of the present invention if a non-UV-curable resin is used it must be a resin which is capable of

becoming a solid matrix to hold the iridescent surface in place.

Cross-linkable resins - It is suggested that resins such as epoxy and alkyd resins may also be used. However, it is important that a number of these take some considerable time to cure. If the change has not taken place by the time the paper is reeled, the whole reel of paper is glued together or resin transfer to adjacent sheets can occur.

When non-curable and cross-linkable resins are used, it is necessary that the amount added is carefully controlled. Since these resins do not actually cure, it is important that the paper is not saturated, which could mark adjacent paper on the reel.

IRIDESCENT SUBSTANCES

A preferred substance is IRIODIN (trade mark) which are mica platelets coated with titanium dioxide (TiO_2) supplied by Merck AG. The substance comes in a range of colours depending on the thickness of the TiO_2 coating with a particle size ranging from about 5 to 100 microns.

In one example of a banknote made from paper made according to the invention, the quantity of platelets added to the resin is 40% by weight of the resin.

CLAIMS:-

1. A method of making paper comprising the steps of depositing fibres onto a support surface to form a porous absorbent sheet, applying a composition comprising a transparentising resin containing an iridescent substance to at least a portion of said porous sheet and subsequently impregnating the porous sheet with a sizing resin.

2. A method as claimed in claim 1 in which the composition is applied in the quantity of at least 5% by weight of composition to the porous sheet.

3. A method as claimed in claim 1 or claim 2 in which the composition is applied in the quantity of at least 10% by weight of composition to the porous sheet.

4. A method as claimed in any one of the preceding claims in which the composition applied using a screen printing process.

5. A method as claimed in any one of the preceding claims in which the transparentising resin is a non-curable or cross-linkable resin.

6. A method as claimed in any of the claims 1 to 4 in which the transparentising resin is a curable resin, curable when subjected to ultra-violet or electron beam radiation.

7. A method as claimed in claim 6 further comprising the step of subjecting the porous sheet to ultra-violet radiation to cure the transparentising resin before impregnation with the sizing resin.

8. A method as claimed in any one of the preceding claims further comprising the step of forming a low grammage area in the porous sheet and applying the composition to at least partially overlap said low grammage area.

9. A method as claimed in any one of claims 1 to 7 further comprising the step of forming a low grammage area in the porous sheet and applying the composition in a border around said low grammage area.

10. A method as claimed in claim 8 or 9 in which the low grammage area is a watermark.

11. A method as claimed in any one of the preceding claims further comprising the step of creating in the porous sheet a streak of fibres of a different type to those of the porous sheet and applying the composition to at least a part of said streak.

12. A method as claimed in any one of the preceding claims in which a luminescent dye is added to the composition.

13. A method as claimed in any one of the preceding claims in which a wetting agent is added to the composition.

14. A method as claimed in any one of the preceding claims in which the viscosity of the transparentising resin is controlled to control the transparency of the paper.

15. A method as claimed in any one of the preceding claims further comprising the step of embossing the paper using a combination of heat and pressure.

16. A method as claimed in any one of the preceding claims further comprising the step of calendering the sized sheet.

17. Paper produced by a method as claimed in any one of the preceding claims.

18. Paper comprising at least one area which has been transparentised further comprising at least one iridescent coating located at least partially over the transparentised area which exhibits a different colour when viewed in transmitted or reflected light.

19. Paper as claimed in claim 18 in which the coating comprises a transparentising resin containing particles of an iridescent substance.

20. Paper as claimed in claim 18 or claim 19 in which the iridescent substance comprise mica particles.

21. A security document comprising or produced from paper as claimed in any one of claims 17 to 20.

22. Apparatus for making paper comprising in combination paper forming apparatus including means for depositing fibres onto a support surface to form a porous absorbent sheet, means for applying a composition comprising a transparentising resin containing an iridescent substance to at least a portion of said sheet, a sizing resin bath and means for transporting said porous sheet therebetween.

23. A method of making paper substantially as hereinbefore described with reference to the accompanying drawings.

24. Paper substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

25. Apparatus substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

Patents Act 1977 Examiner's report to the Comptroller under Section 17 (The Search report) -22-	Application number GB 9320206.7
Relevant Technical Fields (i) UK Cl (Ed.M) B6A (ATC); D1R (RBX, RFCA, RFZ, RGCA, RGZ); D2A (AP) (ii) Int Cl (Ed.5) B41M 3/14; B42D 15/00; D21H 21/26, 21/40	Search Examiner ALEX LITTLEJOHN Date of completion of Search 15 NOVEMBER 1993
Databases (see below) (i) UK Patent Office collections of GB, EP, WO and US patent specifications. (ii) ONLINE DATABASES: WPI	Documents considered relevant following a search in respect of Claims :- 1-25

Categories of documents

X:	Document indicating lack of novelty or of inventive step.	P:	Document published on or after the declared priority date but before the filing date of the present application.
Y:	Document indicating lack of inventive step if combined with one or more other documents of the same category.	E:	Patent document published on or after, but with priority date earlier than, the filing date of the present application.
A:	Document indicating technological background and/or state of the art.	&:	Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
Y	GB 1489084	(TULLIS RUSSELL) see transparentisation effect	18-21
Y	EP 0493231 A1	(ARJO WIGGINS) see irridescent effect	18-21
Y	EP 0490825 A1	(ZURCHER) see irridescent effect	18-21
Y	EP 0388090 A1	(DE LA RUE) see transparentising effect and note especially Figure 3	18-21
Y	US 4513056	(VERNOIS) see transparentising effect	18-21

Databases:The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).